8. CONCLUSIONS

This report describes the analysis of 21 implementation scenarios. Eight scenarios, including the reference program implementation scenario, begin receipt of waste in 2010, and 13 scenarios begin early receipt at the repository in 2007. Nineteen of the scenarios employ a modularized CRWMS with phased construction and operation of the modules. The two scenarios that do not employ the modularized CRWMS include: (1) the reference program implementation scenario, and (2) the reference program scenario with a small transport construction cost alternative to the branch rail line, assumed in the reference scenario. Each scenario appears achievable, and each would provide capability to accept commercial SNF, naval SNF, DOE SNF, high-level waste with immobilized plutonium, and high-level waste without immobilized plutonium.

The evaluations described in this report support the following conclusions:

- Modularized repository facilities could be employed to significantly reduce the peak required annual cost for scenarios that start waste acceptance in 2010. The penalties that would be incurred by deferring construction of modules include decreases in potential CRWMS effectiveness and increases in potential societal costs. The penalty for extended deferral of completion of repository facilities in scenario 8 would also include a noticeable (15 percent) increase in total life cycle costs, although the increase is reduced to 6 percent when the costs are discounted to take into account the time value of money. Increases in total CRWMS life cycle costs for the other scenarios would be less than 5 percent. The modularized repository incurs licensing risks in addition to those for the reference design.

- Impacts on CRWMS life cycle costs caused by deferring construction of repository facilities and Nevada transportation infrastructure could be limited to small increases. However, experience with increases in costs associated with extending construction activities in U.S. nuclear projects suggests that these life cycle cost increases may be larger than the estimates in this report.

- The ability of utilities to minimize their storage costs at shutdown reactors is greatest if Nevada transportation is rail or full-scale heavy haul that can sustain target receipt rates. If Nevada transportation is mostly legal weight truck, then utilities would not have the option of storing SNF in large DPCs, and could be expected to keep their storage pools operating until the SNF has been picked up by the CRWMS. If Nevada transportation is rail or heavy haul that can sustain target receipt rates, then the utilities would have more cost effective cost options, such as dry storage, for moving fuel from storage pools and closing the pools at sites capable of handling large casks.

- Some early receipt scenarios that employ modularized repository facilities could equal or exceed the capability of the reference program scenario to provide utilities the ability to avoid new dry storage sites. Some scenarios, however, would incur penalties in the potential to reduce utility costs. Early receipt implementation scenarios could increase regulatory impacts and risks.

- Early receipt scenario costs before emplacement begins could be less than those of the reference program scenario. The cumulative costs between 2004 and 2009, before emplacement begins, could be approximately 5 to 15 percent less than the comparable costs for the reference program scenario. The peak early receipt costs could be 75 percent of the peak for the reference program scenario before emplacement begins. The early receipt scenario with initial receipt rates the same as specified in S. 104 and HR 1270, however, would incur cumulative pre-emplacement costs of approximately 5 to 15 percent more than the reference scenario. Its peak annual cost would be within 5 percent of the peak for the reference program scenario.

- Increases in CRWMS total life cycle costs of early receipt scenarios could be limited to less than 5 percent of the costs of the reference CRWMS implementation scenario.

- The rate of waste pick up, not the fact that waste pickup starts earlier than 2010, is the primary reason that utility storage costs are reduced in the early receipt scenarios. Earlier attainment of the target receipt rate, which may be a consequence of early receipt, leads to reduced utility storage costs.

- Use of full-scale heavy haul for the Nevada transportation to the repository, when compared to rail, could accrue advantages in pre-emplacement annual construction costs. Full-scale heavy haul, however, incurs greater operations costs and risks in meeting schedules, controlling costs, and maintaining desired receipt rates since Nevada Department of Transportation permits must be obtained for each heavy-haul shipment of loaded large casks to the repository and each heavy-haul shipment of unloaded large casks from the repository. In addition, the extent of road upgrades to allow heavy haul would be decided by the Nevada Department of Transportation.

- CRWMS implementation scenarios that provide early receipt of waste at the repository could provide improvements in the ability of the CRWMS to remove SNF from utility sites that would otherwise need to establish new dry storage sites. More than half the need for those sites occurs between 2007 and 2010. Early receipt could also improve the ability of the CRWMS to remove SNF from shutdown reactor sites and reduce the cumulative time (site-years) that fuel would be stored at shutdown reactor sites. The extent of such improvements would depend on utilities trading acceptance priority rights so that acceptance rights are made available to the reactors that can benefit most.

- Implementation scenarios that start with a repository surface facility that has augmented capability to transfer canisters to storage at 3000 MTHM per year, are cost effective in reducing the impacts of constrained funding.

- The effectiveness of implementation scenarios that utilize modularized repository facilities could be enhanced, in general, by increases in the total funds that can be expended before 2010. Waste acceptance equal to more than 90 percent of the reference amount of waste acceptance could be achieved by scenarios that have small initial capabilities if funding is increased sufficiently after emplacement operations begin in 2010.

This initial evaluation suggests that peak costs can be reduced significantly if the repository utilizes staged modular construction and if a small transport construction cost alternative can be utilized for transportation to the Yucca Mountain repository site. Should the DOE Program decide to pursue the development of any of these alternatives, additional design studies and analyses would need to be undertaken to improve the confidence for success for such changes to the reference program implementation scenario. The following design studies and analyses would be needed to achieve the confidence necessary to recommend program changes:

- Obtain more detailed information on the cost and schedule risks for developing the required infrastructure for heavy haul and ensuring the initial and continuing approval of heavy-haul shipments by the Nevada Department of Transportation. Develop an operational risk assessment for heavy haul versus rail transportation to the repository.

- Analyze, in consultation with the NRC staff, licensing risks for program implementation scenarios that begin receipt at an initial module of the surface facility and complete the surface facility while receipt and emplacement operations continue.

- Develop more detailed designs and cost analyses for both surface and subsurface facility modules.

- Evaluate, in consultation with the NRC staff, the level of design detail that would need to be available at the time of repository license application if the program strategy were to be changed to seek NRC approval of receipt of SNF in repository facilities as early as 2007. Evaluate the amount of design development required, in addition to that in current program projections for FY1999 to FY2001, to meet NRC expectations.

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